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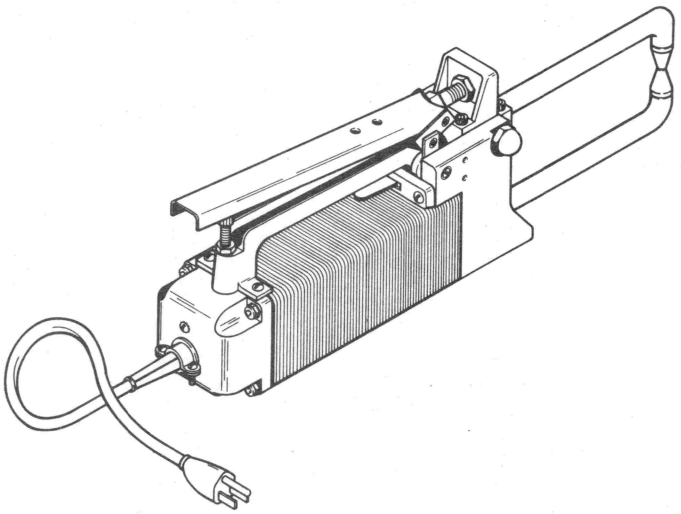

OWNER'S MANUAL

miller

MILLER ELECTRIC MFG. CO.
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APPLETON, WI 54912 USA

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EFFECTIVE: FEBRUARY 20, 1978

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SECTION 1 - SAFETY RULES FOR OPERATION OF ARC WELDING POWER SOURCE

1-1. INTRODUCTION

We learn by experience. Learning safety through personal experience, like a child touching a hot stove is harmful, wasteful, and unwise. Let the experience of others teach you.

Safe practices developed from experience in the use of welding and cutting are described in this manual. Research, development, and field experience have evolved reliable equipment and safe installation, operation, and servicing practices. Accidents occur when equipment is improperly used or maintained. The reason for the safe practices may not always be given. Some are based on common sense, others may require technical volumes to explain. It is wiser to follow the rules.

Read and understand these safe practices before attempting to install, operate, or service the equipment. Comply with these procedures as applicable to the particular equipment used and their instruction manuals, for personal safety and for the safety of others.

Failure to observe these safe practices may cause serious injury or death. When safety becomes a habit, the equipment can be used with confidence.

These safe practices are divided into two Sections: 1 - General Precautions, common to arc welding and cutting; and 2 - Arc Welding (and Cutting)(only).

Reference standards: Published Standards on safety are also available for additional and more complete procedures than those given in this manual. They are listed in the Standards Index in this manual. ANSI Z49.1 is the most complete.

The National Electrical Code, Occupational Safety and Health Administration, local industrial codes, and local inspection requirements also provide a basis for equipment installation, use, and service.

1-2. GENERAL PRECAUTIONS

A. Burn Prevention

Wear protective clothing - leather (or asbestos) gauntlet gloves, hat, and high safety-toe shoes. Button shirt collar and pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag.

Wear helmet with safety goggles or glasses with side shields underneath, appropriate filter lenses or plates (protected by clear cover glass). This is a MUST for welding or cutting, (and chipping) to protect the eyes from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered. See 1-3A.2.

Avoid oily or greasy clothing. A spark may ignite them.

Hot metal such as electrode stubs and workpieces should never be handled without gloves.

Medical first aid and eye treatment. First aid facilities and a qualified first aid person should be available for each shift unless medical facilities are close by for immediate treatment of flash burns of the eyes and skin burns.

Ear plugs should be worn when working on overhead or in a confined space. A hard hat should be worn when others work overhead.

Flammable hair preparations should not be used by persons intending to weld or cut.

B. Toxic Fume Prevention

Adequate ventilation. Severe discomfort, illness or death can result from fumes, vapors, heat, or oxygen enrichment or depletion that welding (or cutting) may produce. Prevent them with adequate ventilation as described in ANSI Standard Z49.1 listed 1 in Standards index. NEVER ventilate with oxygen.

Lead -, cadmium -, zinc -, mercury -, and beryllium - bearing and similar materials, when welded (or cut) may produce harmful concentrations of toxic fumes. Adequate local exhaust ventilation must be used, or each person in the area as well as the operator must wear an air-supplied respirator. For beryllium, both must be used.

Metals coated with or containing materials that emit toxic fumes should not be heated unless coating is removed from the work surface, the area is well ventilated, or the operator wears an air-supplied respirator.

Work in a confined space only while it is being ventilated and, if necessary, while wearing an air-supplied respirator.

Gas leaks in a confined space should be avoided. Leaked gas in large quantities can change oxygen concentration dangerously. Do not bring gas cylinders into a confined space.

Leaving confined space, shut OFF gas supply at source to prevent possible accumulation of gases in the space if downstream valves have been accidently opened or left open. Check to be sure that the space is safe before re-entering it.

Vapors from chlorinated solvents can be decomposed by the heat of the arc (or flame) to form PHOSGENE, a highly toxic gas, and other lung and eye irritating products. The ultraviolet (radiant) energy of the arc can also decompose trichloroethylene and perchloroethylene vapors to form phosgene. DO NOT WELD or cut where solvent vapors can be drawn into the welding or cutting atmosphere or where the radiant energy can penetrate to atmospheres containing even minute amounts of trichloroethylene or perchloroethylene.

C. Fire and Explosion Prevention

Causes of fire and explosion are: combustibles reached by the arc, flame, flying sparks, hot slag or heated material; misuse of compressed gases and cylinders; and short circuits.

BE AWARE THAT flying sparks or falling slag can pass through cracks, along pipes, through windows or doors, and through wall or floor openings, out of sight of the goggled operator. Sparks and slag can fly 35 feet.

To prevent fires and explosion:

Keep equipment clean and operable, free of oil, grease, and (in electrical parts) of metallic particles that can cause short circuits.

If combustibles are in area, do NOT weld or cut. Move the work if practicable, to an area free of combustibles. Avoid paint spray rooms, dip tanks, storage areas, ventilators. If the work cannot be moved, move combustibles at least 35 feet away out of reach of sparks and heat; or protect against ignition with suitable and snug-fitting, fire-resistant covers or shields.

Walls touching combustibles on opposite sides should not be welded on (or cut). Walls, ceilings, and floor near work should be protected by heat-resistant covers or shields.

Fire watcher must be standing by with suitable fire extinguishing equipment during and for some time after welding or cutting if:

a. appreciable combustibles (including building construction) are within 35 feet
b. appreciable combustibles are further than 35 feet but can be ignited by sparks
c. openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks
d. combustibles adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.

Hot work permit should be obtained before operation to ensure supervisor's approval that adequate precautions have been taken.

After work is done, check that area is free of sparks, glowing embers, and flames.

An empty container that held combustibles, or that can produce flammable or toxic vapors when heated, must never be welded on or cut, unless container has first been cleaned as described in AWS Standard A6.0, listed 3 in Standards index.

This includes: a thorough steam or caustic cleaning (or a solvent or water washing, depending on the combustible's solubility) followed by purging and inerting with nitrogen or carbon dioxide, and using protective equipment as recommended in A6.0. Waterfilling just below working level may substitute for inerting.

A container with unknown contents should be cleaned (see paragraph above). Do NOT depend on sense of smell or sight to determine if it is safe to weld or cut.

Hollow castings or containers must be vented before welding or cutting. They can explode.

Explosive atmospheres. Never weld or cut where the air may contain flammable dust, gas, or liquid vapors (such as gasoline).

D. Compressed Gas Equipment

Standard precautions. Comply with precautions in this manual, and those detailed in CGA Standard P-1, PRECAUTIONS FOR SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, listed 6 in Standards index.

1. Pressure Regulators

Regulator relief valve is designed to protect only the regulator from overpressure; it is not intended to protect any downstream equipment. Provide such protection with one or more relief devices.

Never connect a regulator to a cylinder containing gas other than that for which the regulator was designed.

Remove faulty regulator from service immediately for repair (first close cylinder valve). The following symptoms indicate a faulty regulator:

Leaks - if gas leaks externally.
Excessive Creep - if delivery pressure continues to rise with downstream valve closed.
Faulty Gauge - if gauge pointer does not move off stop pin when pressurized, nor returns to stop pin after pressure release.

Repair. Do NOT attempt repair. Send faulty regulators for repair to manufacturer's designated repair center, where special techniques and tools are used by trained personnel.

2. Cylinders

Cylinders must be handled carefully to prevent leaks and damage to their walls, valves, or safety devices:

Avoid electrical circuit contact with cylinders including third rails, electrical wires, or welding circuits. They can produce short circuit arcs that may lead to a serious accident. (See 1-3C.)

ICC or DOT marking must be on each cylinder. It is an assurance of safety when the cylinder is properly handled.

Identifying gas content. Use only cylinders with name of gas marked on them; do not rely on color to identify gas content. Notify supplier if unmarked. NEVER DEFACE or alter name, number, or other markings on a cylinder. It is illegal and hazardous.

Empties: Keep valves closed, replace caps securely; mark MT; keep them separate from FULLS and return promptly.

Prohibited use. Never use a cylinder or its contents for other than its intended use, NEVER as a support or roller.

Locate or secure cylinders so they cannot be knocked over.

Passageways and work areas. Keep cylinders clear of areas where they may be struck.

Transporting cylinders. With a crane, use a secure support such as a platform or cradle. Do NOT lift cylinders off the ground by their valves or caps, or by chains, slings, or magnets.

Do NOT expose cylinders to excessive heat, sparks, slag, and flame, etc. that may cause rupture. Do not allow contents to exceed 130°F. Cool with water spray where such exposure exists.

Protect cylinders particularly valves from bumps, falls, falling objects, and weather. Replace caps securely when moving cylinders.

Stuck valve. Do NOT use a hammer or wrench to open a cylinder valve that can not be opened by hand. Notify your supplier.

Mixing gases. Never try to mix any gases in a cylinder.

Never refill any cylinder.

Cylinder fittings should never be modified or exchanged.

3. Hose

Prohibited use. Never use hose other than that designed for the specified gas. A general hose identification rule is: red for fuel gas, green for oxygen, and black for inert gases.

Use ferrules or clamps designed for the hose (not ordinary wire or other substitute) as a binding to connect hoses to fittings.

No copper tubing splices. Use only standard brass fittings to splice hose.

Avoid long runs to prevent kinks and abuse. Suspend hose off ground to keep it from being run over, stepped on, or otherwise damaged.

Coil excess hose to prevent kinks and tangles.

Protect hose from damage by sharp edges, and by sparks, slag, and open flame.

Examine hose regularly for leaks, wear, and loose connections. Immerse pressured hose in water; bubbles indicate leaks.

Repair leaky or worn hose by cutting area out and splicing (1-2D3). Do NOT use tape.

4. Proper Connections

Clean cylinder valve outlet of impurities that may clog orifices and damage seats before connecting regulator. Except for hydrogen, crack valve momentarily, pointing outlet away from people and sources of ignition. Wipe with a clean lintless cloth.

Match regulator to cylinder. Before connecting, check that the regulator label and cylinder marking agree, and that the regulator inlet and cylinder outlet match. NEVER CONNECT a regulator designed for a particular gas or gases to a cylinder containing any other gas.

Tighten connections. When assembling threaded connections, clean and smooth seats where necessary. Tighten. If connection leaks, disassemble, clean, and retighten using properly fitting wrench.

Adapters. Use a CGA adapter (available from your supplier) between cylinder and regulator, if one is required. Use two wrenches to tighten adapter marked RIGHT and LEFT HAND threads.

Regulator outlet (or hose) connections may be identified by right hand threads for oxygen and left hand threads (with grooved hex on nut or shank) for fuel gas.

5. Pressurizing Steps:

Drain regulator of residual gas through suitable vent before opening cylinder (or manifold valve) by turning adjusting screw in (clockwise). Draining prevents excessive compression heat at high pressure seat by allowing seat to open on pressurization. Leave adjusting screw engaged slightly on single-stage regulators.

Stand to side of regulator while opening cylinder valve.

Open cylinder valve slowly so that regulator pressure increases slowly. When gauge is pressurized (gauge reaches regulator maximum) leave cylinder valve in following position: For oxygen, and inert gases, open fully to seal stem against possible leak. For fuel gas, open to less than one turn to permit quick emergency shutoff.

Use pressure charts (available from your supplier) for safe and efficient, recommended pressure settings on regulators.

Check for leaks on first pressurization and regularly thereafter. Brush with soap solution (capful of Ivory Liquid* or equivalent per gallon of water). Bubbles indicate leak. Clean off soapy water after test; dried soap is combustible.

E. User Responsibilities

Remove leaky or defective equipment from service immediately for repair. See User Responsibility statement in equipment manual.

F. Leaving Equipment Unattended

Close gas supply at source and drain gas.

G. Rope Staging-Support

Rope staging-support should not be used for welding or cutting operation; rope may burn.

1-3. ARC WELDING

Comply with precautions in 1-1, 1-2, and this section. Arc Welding, properly done, is a safe process, but a careless operator invites trouble. The equipment carries high currents at significant voltages. The arc is very bright and hot. Sparks fly, fumes rise, ultraviolet and infrared energy radiates, weldments are hot, and compressed gases may be used. The wise operator avoids unnecessary risks and protects himself and others from accidents. Precautions are described here and in standards referenced in index.

A. Burn Protection

Comply with precautions in 1-2.

The welding arc is intense and visibly bright. Its radiation can damage eyes, penetrate lightweight clothing, reflect from light-colored surfaces, and burn the skin and eyes. Skin burns resemble acute sunburn, those from gas-shielded arcs are more severe and painful. DON'T GET BURNED; COMPLY WITH PRECAUTIONS.

1. Protective Clothing

Wear long-sleeve clothing (particularly for gas-shielded arc) in addition to gloves, hat, and shoes (1-2A). As necessary, use additional protective clothing such as leather jacket or sleeves, flame-proof apron, and fire-resistant leggings. Avoid outergarments of untreated cotton.

Bare skin protection. Wear dark, substantial clothing. Button collar to protect chest and neck and button pockets to prevent entry of sparks.

2. Eye and Head Protection

Protect eyes from exposure to arc. NEVER look at an electric arc without protection.

Welding helmet or shield containing a filter plate shade no. 12 or denser must be used when welding. Place over face before striking arc.

Protect filter plate with a clear cover plate.

Cracked or broken helmet or shield should NOT be worn; radiation can pass through to cause burns.

Cracked, broken, or loose filter plates must be replaced IMMEDIATELY. Replace clear cover plate when broken, pitted, or spattered.

Flash goggles with side shields MUST be worn under the helmet to give some protection to the eyes should the helmet not be lowered over the face before an arc is struck. Looking at an arc momentarily with unprotected eyes (particularly a high intensity gas-shielded arc) can cause a retinal burn that may leave a permanent dark area in the field of vision.

3. Protection of Nearby Personnel

Enclosed welding area. For production welding, a separate room or enclosed bay is best. In open areas, surround the operation with low-reflective, non-combustible screens or panels. Allow for free air circulation, particularly at floor level.

Viewing the weld. Provide face shields for all persons who will be looking directly at the weld.

Others working in area. See that all persons are wearing flash goggles.

Before starting to weld, make sure that screen flaps or bay doors are closed.

B. Toxic Fume Prevention

Comply with precautions in 1-2B.

Generator engine exhaust must be vented to the outside air. Carbon monoxide can kill.

C. Fire and Explosion Prevention

Comply with precautions in 1-2C.

Equipment's rated capacity. Do not overload arc welding equipment. It may overheat cables and cause a fire.

Loose cable connections may overheat or flash and cause a fire.

Never strike an arc on a cylinder or other pressure vessel. It creates a brittle area that can cause a violent rupture or lead to such a rupture later under rough handling.

D. Compressed Gas Equipment

Comply with precautions in 1-2D.

E. Shock Prevention

Exposed hot conductors or other bare metal in the welding circuit, or in ungrounded, electrically-HOT equipment can fatally shock a person whose body becomes a conductor. DO NOT STAND, SIT, LIE, LEAN ON, OR TOUCH a wet surface when welding, without suitable protection.

To protect against shock:

Keep body and clothing dry. Never work in damp area without adequate insulation against electrical shock. Stay on a dry duckboard, or rubber mat when dampness or sweat can not be avoided. Sweat, sea water, or moisture between body and an electrically HOT part - or grounded metal - reduces the body surface electrical resistance, enabling dangerous and possibly lethal currents to flow through the body.

1. Grounding the Equipment

When installing, connect the frames of each unit such as welding power source, control, work table, and water circulator to the building ground. Conductors must be adequate to carry ground currents safely. Equipment made electrically HOT by stray current may shock, possibly fatally. Do NOT GROUND to electrical conduit, or to a pipe carrying ANY gas or a flammable liquid such as oil or fuel.

Three-phase connection. Check phase requirement of equipment before installing. If only 3-phase power is available, connect single-phase equipment to only two wires of the 3-phase line. Do NOT connect the equipment ground lead to the third (live) wire, or the equipment will become electrically HOT - a dangerous condition that can shock, possibly fatally.

Before welding, check ground for continuity. Be sure conductors are touching bare metal of equipment frames at connections.

If a line cord with a ground lead is provided with the equipment for connection to a switchbox, connect the ground lead to the grounded switchbox. If a three-prong plug is added for connection to a grounded mating receptacle, the ground lead must be connected to the ground prong only. If the line cord comes with a three-prong plug, connect to a grounded mating receptacle. Never remove the ground prong from a plug, or use a plug with a broken off ground prong.

*Trademark of Proctor & Gamble.

2. Electrode Holders

Fully insulated electrode holders should be used. Do NOT use holders with protruding screws.

3. Connectors

Fully insulated lock-type connectors should be used to join welding cable lengths.

4. Cables

Frequently inspect cables for wear, cracks and damage. IMMEDIATELY REPLACE those with excessively worn or damaged insulation to avoid possibly - lethal shock from bared cable. Cables with damaged areas may be taped to give resistance equivalent to original cable.

Keep cable dry, free of oil and grease, and protected from hot metal and sparks.

5. Terminals And Other Exposed Parts

Terminals and other exposed parts of electrical units should have insulating covers secured before operation.

6. Electrode Wire

Electrode wire becomes electrically HOT when the power switch of gas metal-arc welding equipment is ON and welding gun trigger is pressed. Keep hands and body clear of wire and other HOT parts.

7. Safety Devices

Safety devices such as interlocks and circuit breakers should not be disconnected or shunted out.

Before installation, inspection, or service, of equipment, shut OFF all power and remove line fuses (or lock or red-tag switches) to prevent accidental turning ON of power. Disconnect all cables from welding power source, and pull all 115 volts line-cord plugs.

Do not open power circuit or change polarity while welding. If, in an emergency, it must be disconnected, guard against shock burns, or flash from switch arcing.

Leaving equipment unattended. Always shut OFF and disconnect all power to equipment.

Power disconnect switch must be available near the welding power source.

1-4. STANDARDS BOOKLET INDEX

For more information, refer to the following standards or their latest revisions and comply as applicable:

1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING obtainable from the American Welding Society, 2501 NW 7th St., Miami, Fla. 33125.
2. ANSI Standard Z87.1, SAFE PRACTICE FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.
3. American Welding Society Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable same as item 1.
4. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING AND CUTTING, obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, Mass. 02210.
5. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable same as item 4.
6. CGA Pamphlet P-1. SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 500 Fifth Avenue, New York, N. Y. 10036.
7. OSHA Standard 29 CFR, Part 1910, Subpart Q, WELDING, CUTTING AND BRAZING.

SECTION 2 - INTRODUCTION

2-1. GENERAL

This manual has been prepared especially for use in familiarizing personnel with the design, installation, operation, maintenance, and troubleshooting of this equipment. All information presented herein should be given careful consideration to assure optimum performance of this equipment.

2-2. RECEIVING-HANDLING

Prior to installing this equipment, clean all packing material from around the unit and carefully inspect for any damage that may have occurred during shipment. Any claims for loss or damage that may have occurred in transit must be filed by the purchaser with the carrier. A copy of the bill of lading and freight bill will be furnished by the carrier on request if occasion to file claim arises.

When requesting information concerning this equipment, it is essential that Model Designation and/or Stock Number and Serial (or Style) Number of the equipment be supplied.

2-3. DESCRIPTION

This resistance spot welder is designed for maximum portability in sheet metal fabrication where speed and strength of low cost resistance welding is required. The weight of the resistance spot welder is light enough so that it can be carried and held in position while making the weld.

This resistance spot welder consists of a power transformer, switch for initiating the current and multi-pressure lever for operating the tongs, bringing them in contact with the material until the two pieces of metal are properly fused together.

2-4. SAFETY

Before the equipment is put into operation, the safety section at the front of this manual should be read completely. This will help avoid possible injury due to misuse or improper welding applications.

The following definitions apply to CAUTION, IMPORTANT, and NOTE blocks found throughout this manual:

CAUTION

Under this heading, installation, operating, and maintenance procedures or practices will be found that if not carefully followed may create a hazard to personnel.

IMPORTANT

Under this heading, installation, operating, and maintenance procedures or practices will be found that if not carefully followed may result in damage to equipment.

NOTE

Under this heading, explanatory statements will be found that need special emphasis to obtain the most efficient operation of the equipment.

Model	Rated Output Amperes 6" Tongs	Rated Output Amperes 12" Tongs	Rated Output Amperes 18" Tongs	Open-Circuit Voltage	Work Cap. Mild Steel	15 pct. Duty Cycle	50 pct. Duty Cycle	Primary Input Single-Phase
110 Volt 1.5 kva	5500	4550	3600	1.6	1/8"	3.1 kva	1.5 kva	110 Volt, ac, 60 Hz
220 Volt 1.5 kva	5500	4550	3600	1.6	1/8"	3.1 kva	1.5 kva	220 Volt, ac, 60 Hz
230 Volt 2.5 kva	6750	5800	4850	2.5	3/16"	5.2 kva	2.5 kva	230 Volt, ac, 60 Hz

Figure 2-1. Specifications

SECTION 3 - INSTALLATION

3-1. LINE DISCONNECT SWITCH

CAUTION

A precautionary measure should be taken to provide maximum protection against electrical shock. When electrical connections are made from the resistance spot welder to the main line disconnect switch, be sure the line disconnect switch is open or primary input circuit fuses are removed until connections are completed.

Proper installation can contribute materially to the satisfactory and trouble-free operation of the resistance spot welder. It is suggested that each step in this section be studied carefully and followed in detail.

3-2. PRIMARY CONNECTIONS

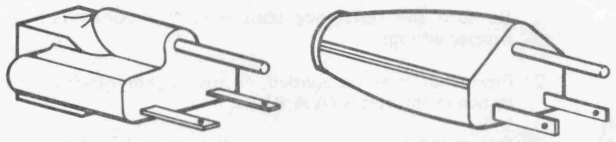
The resistance spot welder should be operated from a separately fused or circuit breaker protected circuit. The maximum capacity of the resistance spot welder is affected by the line voltage and if the circuit is overloaded, the performance of the resistance spot welder will be impaired.

For installing the resistance spot welder, a three conductor cable of proper size (See Table 3-1) should be run from a line disconnect switch to either a 110 volt (Parallel) receptacle or a 220/230 volt (Tandem) receptacle. Remember that the cord on the resistance spot welder is 10 feet long. Install the receptacle at a location so that ample cord length is available for proper spot welding maneuverability.

Table 3-1. Recommended Wire and Fuse Size

Model	Wire Size (AWG)	Fuse Size (Amperes)
110 Volt 1.5 kva	No. 10	30
220 Volt 1.5 kva	No. 12	15
230 Volt 2.5 kva	No. 10	30

All resistance spot welders are equipped with a 10 foot length of 3 conductor cable with plug attached. Resistance spot welders have a 3 conductor cord with a parallel prong plug for the 100 volt model and a tandem plug for the 220/230 volt models. See Figure 3-1.



Tandem Plug 220/230 Volt — **Parallel Plug 110 Volt**

TA-001 911

Figure 3-1. 110 and 220 Volt Primary Plugs

CAUTION

Do not cut off the ground terminal on the cord plug. This should be attached to a suitable ground such as the electrical conduit system or a water system or a driven ground rod before operating the resistance spot welder to assure operator's protection. It may be necessary to have an electrician install grounded type power receptacle.

The two parallel or tandem prongs are for connection to the power lines and the third prong (the green wire in the cord) is for grounding the resistance spot welder.

3-3. TONG INSTALLATION

Refer to Figure 3-2 for tong installation. The bottom tong must be inserted into the holder as far as it will go. Then tighten all four socket head cap screws (H & J). The top tong is inserted to the point where its tip lines up with the bottom tong tip. Then tighten all four socket head cap screws (F & G).

3-4. TONG PRESSURE

The hand lever is used to apply pressure to the spot welding tips and the switch under the handle activates the welding current. Bring the material to be welded into intimate contact before applying pressure from the spot welding tongs. Do not use the tong pressure to bring two pieces of metal together.

Pressure on the tips is increased by loosening the nut on the front of the pivoting casting (K) and running the nut in rear of the casting (L) up tight, locking the casting between the two nuts. The farther the front nut is run out, the greater the pressure on the tips when the handle is closed. To decrease the pressure on the tips, reverse this procedure. Turn the rear nut back on the tie bolt and close the front nut back against the casting. The pressure should be adjusted according to the combined thickness of the metal to be spot welded.

At the rear of the handle is a machine screw (I). The farther down this machine screw is run, the farther the handle will close. Adjustments of this screw determines whether the lever will pivot past center and lock the tongs on the material or merely pull up tight. The screw should be adjusted to allow the lever to be raised easily after the weld has been completed.

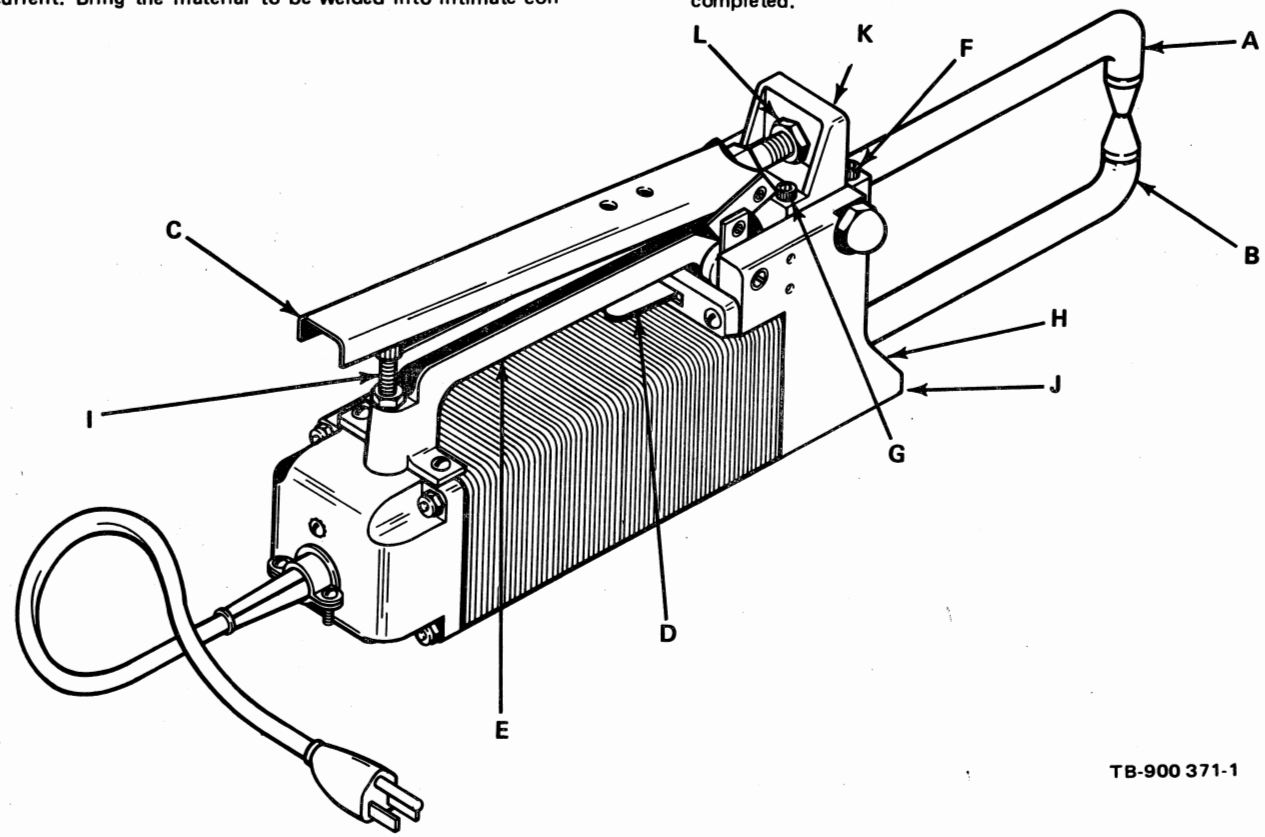


Figure 3-2. Spot Welding Machine

SECTION 4 - OPERATION

4-1. RESISTANCE SPOT WELDING

1. Be sure the resistance spot welder is connected to the proper voltage.
2. Place metals to be welded, firmly together before placing between the tongs (A & B).
3. Compress the operating lever (C) above handle (E) bringing the tong tips in contact with the metal to be spot welded. Be sure the tong pressure is correct as explained in Step No. 4.

CAUTION

Keep tong tips dressed down to within 1/8" diameter or less for the 1.5 kva models and to within 5/32" diameter or less for the 2.5 kva model. Greater diameters reduce the capacity of the unit. Heat concentrated in a smaller area improves efficiency and reduces heating of the resistance spot welder. See "Dressing Tong Tips" under Maintenance.

4. Use thumb or forefinger to operate the momentary contact switch (D) located underneath the carrying handle (E).
5. Hold switch (D) in closed position until weld is completed. Do not release pressure on tongs while switch (D) is closed as this will tend to cause excess burning of the tong tips.
6. High scale metals such as hot rolled steel are not readily spot welded due to the high resistance of the scale. It is important that the metal to be spot welded be clean.

NOTE

Galvanized metals of over 20 gauge should not be spot welded with the 110 or 220 volt 1.5 kva models and not over 18 gauge with the 230 volt 2.5 kva model. Keep tips clean and properly dressed.

SECTION 5 - MAINTENANCE

5-1. CHANGING TONGS

Tongs are readily changed. There are four socket head cap screws holding each tong in position. When changing the tongs the bottom tong must be inserted into the holder as far as it will go. Then tighten the socket cap screws. The top tong is inserted into the holder until the tip aligns with the bottom tip, then tighten the socket head cap screws.

NOTE

Wipe both tong and tong holder clean. Any bends or nicks on the end of the tongs that connect the tong holders will impair proper contact and reduce the maximum capacity and efficiency of the resistance spot welder. If corroded, polish with crocus cloth. Examine tong tips for dents, nicks, or mushroom.

5-2. DRESSING TONG TIPS

Electrodes are most effectively dressed by machining the tips. One of the most common mistakes in electrode dressing is the hand filing of the face of the electrode which usually results in dome shaped surface where a flat surface is required. Only in the hands of a very experienced filer can electrodes be properly dressed, and usually filed tip faces are not parallel, therefore, hand filing is discouraged. The tendency for the file to be used at an angle is always present, with gross tip mismating and poor quality welds resulting.

A file, however, can be advantageously used in removing the "mushroom" from the electrodes providing the filing is confined to the tapered sides of the tip instead of on the surface of the tip.

One of the hand operated electrode dressers, uses emery cloth, crocus cloth or sandpaper. These abrasives are placed over a hardened tip contour die in a special holder and a very light pressure is exerted on the tips. The rapid twisting motion of the dresser in sanding the tips results in a perfectly dressed electrode face.

SECTION 6 - TROUBLESHOOTING

CAUTION

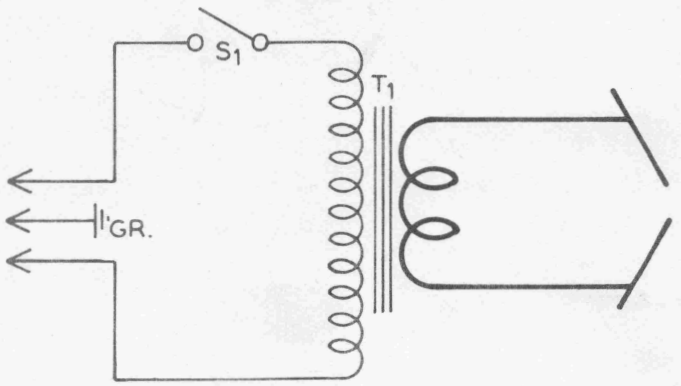
Hazardous voltages are present on the internal circuitry of this unit as long as power is connected. Disconnect power before attempting any inspection or work on the inside of the unit. Troubleshooting of internal circuitry should be performed by qualified personnel only.

The following chart is designed to diagnose and provide remedies for some of the troubles that may develop in this unit.

It is assumed that proper installation has been made, according to Section 3 of this manual, and that the unit has been functioning properly until this trouble developed.

Use this chart in conjunction with the circuit diagram while performing troubleshooting procedures. If the trouble is not remedied after performing these procedures, the nearest Factory Authorized Service Station should be contacted. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly followed.

TROUBLE	PROBABLE CAUSE	REMEDY
No current	Switch defective	Check and replace if necessary.
Low welding current	Switch making poor contact. Braid frayed.	Check cause. Remedy if necessary.
Longer time interval than is required for proper weld.	Poor tips, tightness of tongs, dirt or grease on metal.	Check condition of tips. Check for cause. Remedy if necessary. Check metal being spot welded.



Circuit Diagram No. A-478-A1

Figure 7-1. Circuit Diagram

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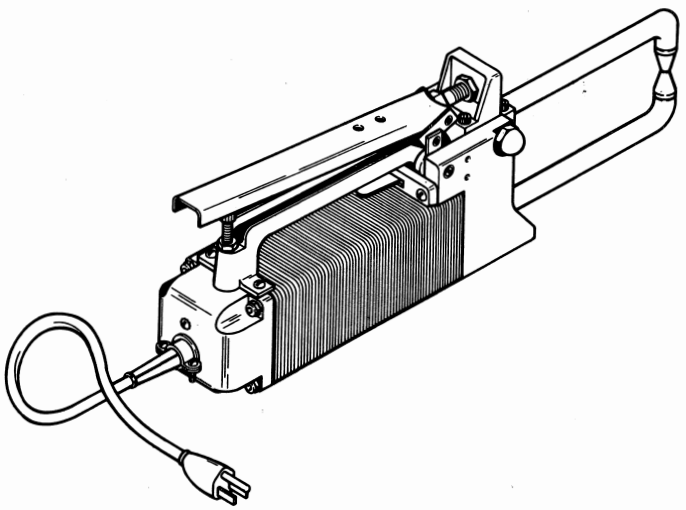
Effective With Style No. S1A1



PARTS LIST

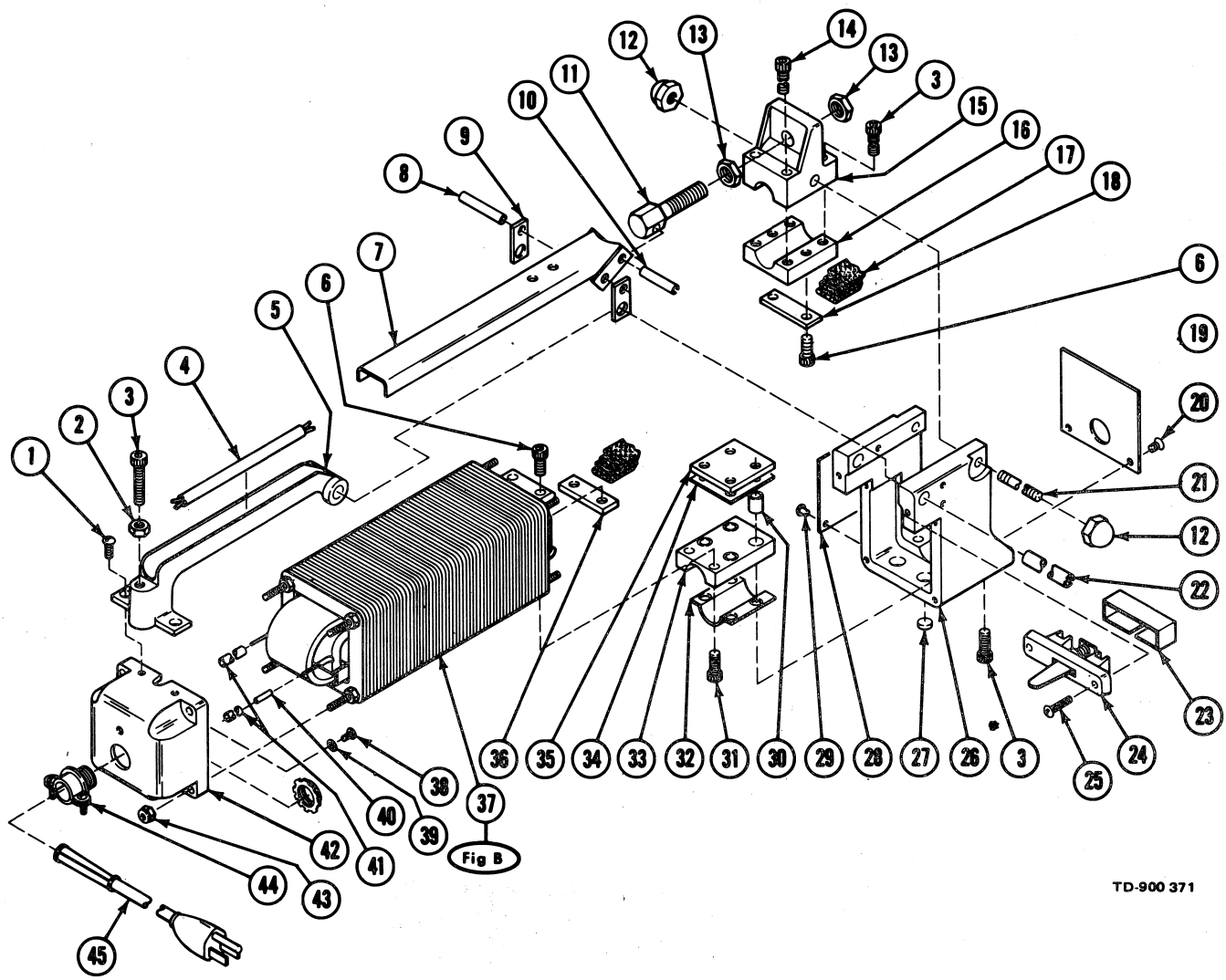


Figure A – Main Assembly

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity Models 110V 1.5 KVA	220V 1.5 KVA	230V 2.5 KVA
Figure A			**Main Assembly**			
1		602 095	SCREW, machine - truss hd 10-32 x 5/8	2	2	2
2		601 865	NUT, hex 1/4-20	1	1	1
3		602 009	SCREW, cap - socket hd 1/4-20 x 1-1/4"	7	7	7
4		023 659	HARNESS, wiring - switch	1	1	
4		023 660	HARNESS, wiring - switch			1
5		019 643	HANDLE, carrying	1	1	
5		019 646	HANDLE, carrying			1
6		602 008	SCREW, cap - socket hd 1/4-20 x 1"	4	4	4
7		024 505	LEVER, operating	1	1	
7		024 504	LEVER, operating			1
8		010 714	PIN, roll 5/16 x 1-3/4"	1	1	1
9		010 712	LINK, toggle - connecting	2	2	2
10		010 713	PIN, roll 5/16 x 1-1/4"	1	1	1
11		010 715	BOLT, pressure adjustment	1	1	1
12		601 854	NUT, hex - cap 3/8-24	2	2	2
13		601 876	NUT, hex - jam 7/16-20	2	2	2
14		010 668	SCREW, cap - socket hd 1/4-20 x 1-1/2"	2	2	2
15		017 668	CASTING, top	1	1	1
16		010 709	CLAMP, top tong	1	1	1
17		010 623	BRAID, tong - set of four	1	1	1
18		010 716	CLAMP, connecting top tong braid	1	1	1
19		026 607	GUARD, spatter	1	1	1
20		602 090	SCREW, machine - flat hd 10-32 x 3/8"	2	2	2
21		010 710	STUD, 3/8 x 3-3/8"	1	1	1
22		010 711	PIN, roll 3/8 x 3"	1	1	1
23		070 017	INSULATION, switch	1	1	1
24	S1	*011 746	SWITCH ASSEMBLY, control (consisting of)	1	1	1
		011 291	. CONTACT, switch	1	1	1
		023 987	. CONTACT, switch - against trigger	1	1	1
		011 292	. TRIGGER, switch	1	1	1
		070 035	. BASE	1	1	1
25		602 094	SCREW, machine - rnd hd 10-32 x 5/8"	2	2	2
26		017 667	CASTING, front	1	1	1
27		026 759	PLUG, insulator - secondary screw	2	2	2
28			NAMEPLATE (order by stock and model number)	1	1	1
29		602 024	SCREW, drive 2 x 3/16"	4	4	4
30		026 606	INSULATION, screw - bottom tong	4	4	4
31		602 004	SCREW, cap - socket hd 1/4-20 x 3/4"	1	1	1
32		026 604	INSULATION, bottom tong	1	1	1
33		010 707	CLAMP, bottom tong	1	1	1
34		026 605	INSULATION, bottom clamp	1	1	1
35		010 708	CLAMP, holding - threaded	1	1	1
36		See Note	CLAMP, threaded - connecting tong braid	1	1	1
37	T1	036 825	TRANSFORMER (See Fig. B Page 3)	1		
37	T1	036 950	TRANSFORMER (See Fig. B Page 3)		1	
37	T1	036 826	TRANSFORMER (See Fig. B Page 3)			1
38		602 037	SCREW, brass - rnd hd 10-32 x 3/16	1	1	1
39		602 205	WASHER, lock - internal tooth No. 10	1	1	1
40		600 675	CONNECTOR, 16-14 wire	3	3	3
41		026 763	TUBING, No. 5 vinyl 2-1/2" long	2	2	2
42		019 642	CASTING, rear	1	1	1
43		601 847	NUT, hex - self locking 10-32	4	4	4
44		010 610	CONNECTOR, cord 1/2"	1	1	1
45		023 602	CORD, with molded plug	1		
45		023 603	CORD, with molded plug		1	1
		602 262	HANDLE, wood	1	1	1
		601 778	BOLT, carriage 1/4 x 4-1/2"	1	1	1

NOTE: Item 36 is no longer available as a separate Piece. It is now included when ordering item 71 shown in Figure B on page 3.

*Recommended Spare Parts

BE SURE TO PROVIDE STOCK, MODEL, AND STYLE NUMBERS WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity Models 110V 1.5 KVA 036 825	220V 1.5 KVA 036 950	230V 2.5 KVA 036 826
Figure B			**Transformer (See Fig. A Page 2 Item 37)**			
61		026 601	INSULATION, coil (consisting of)	1	1	
62		026 772	. INSULATION, 15 mil 4-5/8 x 8"	2	2	
63		026 765	. TUBING, plastic 1-1/4"	1	1	
64		026 774	. INSULATION, 15 mil 1-5/8 x 1-3/4"	1	1	
65		026 770	. INSULATION, 15 mil 5/8 x 7-7/8"	2	2	
61		026 602	INSULATION, coil (consisting of)			1
62		026 773	. INSULATION, 15 mil 4-5/8 x 11"			2
63		026 765	. TUBING, plastic 1-1/4"			1
64		026 774	. INSULATION, 15 mil 1-5/8 x 1-3/4			1
65		025 771	. INSULATION, 15 mil 5/8 x 10-7/8"			2
66	T1	**033 610	COIL, primary	1		
66	T1	**033 611	COIL, primary		1	
66	T1	**033 612	COIL, primary			1
67	T1	**036 613	CORE	1	1	
67	T1	**036 614	CORE			1
68		026 764	INSULATION, 15 mil 1-3/4 x 2-1/2"	1	1	1
69		010 157	STUD, core 3/16 x 8-1/8	4	4	
69		010 156	STUD, core 3/16 x 11-1/8"			4
70		601 863	NUT, hex 10-32	4	4	4
71		033 123	BAR, secondary	1	1	
71		033 122	BAR, secondary			1

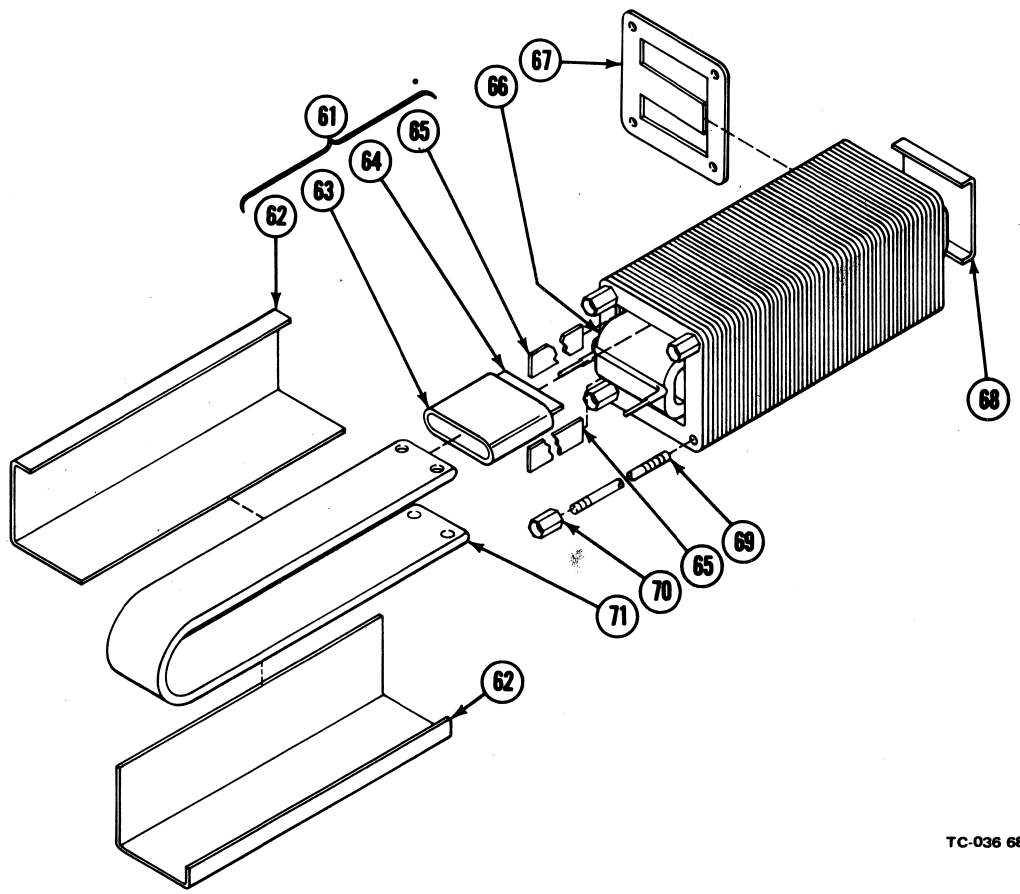


Figure B — Transformer

**Replace At Factory or Authorized Service Station
BE SURE TO PROVIDE STOCK, MODEL, AND STYLE NUMBERS WHEN ORDERING REPLACEMENT PARTS.